SYSTEM TO QUANTIFY CONSUMER PREFERENCES

CROSS-REFERENCE TO RELATED APPLICATIONS

      This application claims priority to Provisional Application Serial No.
60/401,266, filed August 6, 2002 and entitled "System to Quantify Consumer
Preferences".

      This application is related to co-pending U.S. Patent Application Serial No.
09/754,612, filed January 4, 2001 and entitled "System to Quantify Consumer
Preferences".

BACKGROUND

Field

      The present invention relates to systems for determining consumer
preferences. More specifically, the invention relates to self-explicated trade-off
analysis systems used to quantify preferences of a respondent with respect to
product attributes and to product attribute levels.

Discussion

      Manufacturers are presented with many choices during the design of a
product. For example, a manufacturer must choose from among several
available product features, or attributes, when deciding which attributes to
include in a product. Some attributes are optional while others must be included.
In the case of a television set, "Chassis color" is an attribute that must be
included and "Picture-in-picture" is an optional attribute. For each included
attribute, a manufacturer must also choose an attribute level to associate with the
attribute. Examples of attribute levels which may be associated with the attribute
"Chassis color" include "black", "white", "blue", etc.

      Occasionally, a manufacturer produces several versions of a similar
product by varying product attributes and/or attribute levels among the several

versions. In such a case, the manufacturer must determine attributes and associated attribute levels to include in each version as described above. Moreover, the manufacturer must determine how many units of each version will be produced. For example, a manufacturer choosing to produce televisions

5   having a black chassis and televisions having a blue chassis must also determine how many of each type of television to produce and offer for sale.

Product pricing represents a further choice for product manufacturers. In this regard, a manufacturer attempts to choose a price for each produced product that will maximize overall profit to the manufacturer. Of course, price may also

10 be considered a product attribute, with associated attribute levels consisting of particular prices.

Each of the foregoing choices, as well as other choices, may be greatly facilitated if the manufacturer has detailed and accurate information relating to consumer preferences. A consumer, in this regard, is any entity to which a

15 product (i.e. a good and/or service) may be offered. Such consumers include individuals, businesses, and purchasing managers. Consumer preference information can be used to determine the popularity and desirability of particular product attributes and attribute levels to consumers. Therefore, by using this information, a manufacturer is more likely to choose product configurations as

20 well as production amounts and prices for each product configuration that maximize overall profit.

In view of its importance, manufacturers expend significant resources in their attempts to obtain detailed and accurate consumer preference information and to analyze marketplace choices. These resources are most commonly

25 allotted to conventional consumer surveys. Such surveys typically consist of a list of predetermined questions designed to elicit information from a respondent regarding the respondent's feelings toward products, product attributes, and product attribute levels. Surveys may be administered randomly, for example by stopping respondents at shopping malls or other retail areas, or by contacting

30 specific respondents who are targeted because they are members of a demographic group about which information is desired.

Conventional surveys present several inherent drawbacks. First, since survey results are compiled into general demographic categories, surveys merely determine, at best, preferences of a theoretical average consumer belonging to each demographic category. Accordingly, survey results are only marginally

5 correlated to any one respondent's preferences. Therefore, such results lack predictive precision of a particular respondent's preferences with respect to marketplace choices that are available and not yet available. Second, although conventional surveys may indicate whether one attribute level (e.g. "black chassis color") is generally preferred over another attribute level of the same

10 attribute ("white chassis color"), such surveys do not provide any reliable means for comparing preferences across attributes. For example, conventional surveys are generally unable to determine the degree to which a respondent prefers a black chassis to another color so as to enable comparison between that degree and the degree to which the respondent prefers a 27" screen to another screen

15 size. As a result of these drawbacks, conventional surveys are poor at producing useful quantified preference information of individual respondents.

Focus groups are another conventional vehicle used to obtain preference information. In a typical focus group, certain respondents are randomly selected (or selected based on demographics as described above) to answer questions

20 and/or to participate in a group discussion regarding a product or a type of product. Answers and comments put forth by the respondents are noted and tabulated to create preference information similar to that obtained using survey techniques. However, because of their interactive nature, focus groups may elicit information which is more pertinent than that elicited by surveys. Despite this

25 possible advantage, focus groups still suffer from the drawbacks described above with respect to conventional surveys.

The field of trade-off analysis was developed to address the above and other shortcomings in conventional techniques for determining preference information. Generally, trade-off analysis techniques attempt to quantify a

30 respondent's preference for a particular product's attributes and attribute levels. Such quantification is intended to allow a manufacturer to easily and accurately

3

compare the attractiveness of various product configurations to a respondent. For example, many trade-off analysis techniques allow a manufacturer to compare the attractiveness of a 27 " television with Picture-in-picture capability priced at $399 with that of a 35" television with a digital comb filter priced at

5      $599. This comparison is possible because the techniques associate a particular numerical value with a respondent's preference for each attribute and attribute level. Accordingly, the relative attractiveness of any attribute or attribute level with respect to any other attribute or attribute level can often be determined simply by comparing the appropriate associated numerical values.

10   According to one classification scheme, four types of trade-off analysis techniques exist: conjoint; discrete choice; self-explicated; and hybrid. Conjoint analysis generally requires a respondent to rate or rank product configurations with respect to one another. Typically, the consumer is asked to evaluate twenty to thirty product configurations. Each configuration includes different

15   combinations of attributes and attribute levels being evaluated. By appropriately varying the configurations, a regression model can be estimated for each respondent in order to estimate respondent-specific numerical values for the attribute levels.

Conjoint analysis is an improvement over conventional systems for

20   determining preference information. For example, determining preferences by observing respondent behavior is difficult or impossible because respondent behavior can usually be observed only with respect to a few combinations of attributes and attribute levels (i.e., the combinations that exist in the marketplace). Accordingly, it becomes difficult to separate and distinguish

25   between the preferences of different consumers and to predict effects of changes in attributes and/or attribute levels on respondent behavior. On the other hand, conjoint analysis allows for improved learning of respondent preferences through controlled variation and controlled co-variation of attributes and attribute levels.

According to discrete choice analysis, a respondent is presented with a

30   set of product configurations and asked to select either the configuration that the respondent is most interested in purchasing or no configuration if the respondent

4

is not interested in purchasing any of the presented configurations. The process is then repeated for other sets of product configurations. In contrast to conjoint analysis, which may be used to estimate a regression model for individual respondents, discrete choice analysis may be used to estimate a mixture method

5   (similar to a regression model) for a group of respondents.

While conjoint analysis and discrete choice analysis determine respondents' preferences for particular attribute levels of associated attributes indirectly, self-explicated analysis directly determines preferences by asking respondents how important each product attribute range and attribute level range

10   is to their purchasing decisions. According to some self-explicated analysis models, respondents are presented with all attributes and attribute levels to be evaluated, and asked to identify attribute levels that are unacceptable. An unacceptable attribute level is one that, if included in a product, would cause the product to be completely unacceptable to the respondent, regardless of any other

15   attributes and attribute levels included in the product. For example, a respondent may indicate that an automobile including an attribute level of "pink" associated with the attribute "color" is completely unacceptable for purchase regardless of any other attributes or attribute levels included in the automobile. Accordingly, "pink" is identified as an unacceptable attribute level for that respondent.

20   Next, the respondent is asked to identify, from the acceptable attribute levels, the most-desirable and the least-desirable attribute levels associated with each presented attribute. For example, assuming that the respondent's most important attribute has a rating of 100, the consumer is then asked to rate the relative importance of each remaining attribute from 0 to 100. Of course, scales

25   other than 0 to 100 may be used. Next, for each attribute, the desirability of each attribute level is rated with respect to all other acceptable attribute levels of the attribute. The respondent's preference for an attribute level is then obtained by multiplying the relative importance of its associated attribute by its desirability rating.

30   Hybrid analysis techniques utilize a combination of features from the above-described techniques. The most common example of a hybrid analysis

technique is Adaptive Conjoint Analysis (ACA), a product of Sawtooth Software, Inc. According to ACA, a respondent is taken through rankings of attribute levels and ratings of relative attribute importance (similar to self-explicated techniques) and then asked to identify, for each of a series of pairs of product configurations,

5   which one of the pair is the most desirable and the degree to which it is more desirable. Other examples of hybrid models include the Cake Method and the Logit-Cake Method developed by MACRO Consulting, Inc.

Each of these trade-off analysis techniques requires respondents to provide consistent, thoughtful responses to presented inquiries. A respondent

10   may be able to provide such responses if presented with a small number of inquiries, but is unlikely to do so if presented with many inquiries. In this regard, the number of inquiries presented by each of the above techniques increases sharply as the number of evaluated attributes and/or attribute levels increases. Such an increase in the number of inquiries also causes a corresponding

15   increase in the amount of time required to answer the inquiries. Therefore, as more attributes and attribute levels are evaluated, various forms of respondent bias are likely to increase, such as confusion, a waning attention span, a lack of time, a lack of patience, boredom, and haste. These increased respondent biases result in increased respondent error and inaccurate preference

20   information. Also increased is a respondent's tendency to abandon the process and to simply cease answering further inquiries, in which case the resulting preference information is partially or totally unusable.

Another form of respondent bias is caused by consumer attitudes toward particular attributes and/or attribute levels. As described above, conventional

25   trade-off analysis techniques ask a respondent to evaluate the importance of an attribute or attribute level with respect to other attributes or attribute levels. However, if the respondent has an extreme dislike for one of the attributes or attribute levels, the consumer may overestimate the importance of the other attributes or attribute levels. Moreover, a relative importance of an attribute with

30   respect to the difference between its best and worst attribute levels may differ based on a number of intermediate attribute levels presented to a respondent.

In view of the foregoing, what is needed is an efficient trade-off analysis system to quantify consumer preference information. Such a system may or may not address the forms of consumer bias experienced by conventional systems, produce accurate and useful preference information with respect to product

5   attributes and attribute levels, and/or improve manufacturer and/or retailer choices to maximize profit for the manufacturer and/or retailer.

SUMMARY

In order to address the foregoing, the present invention provides a system,

10   method, device, medium and means to provide a user interface including a plurality of selectable graphical elements each representing a respective attribute level of a product attribute, a first area for presenting at least one of the plurality of selectable graphical elements that has been designated by a respondent as representing an unacceptable attribute level, a second area for presenting one of

15   the plurality of selectable graphical elements that has been designated by the respondent as representing a least-preferred attribute level, and a third area for presenting one of the plurality of selectable graphical elements that has been designated by the respondent as representing a most-preferred attribute level.

In some aspects, the present invention provides interface elements

20   manipulable by a respondent to designate one or more product attribute levels as unacceptable, to designate a first attribute level as a least-preferred attribute level, and to designate a second attribute level as a most-preferred attribute level.

Some aspects of the present invention include a first determination, for

25   each of a plurality of attribute levels associated with a product attribute, of a classification of the attribute level as one of unacceptable, most-preferred, least-preferred, or intermediately-preferred, a second determination, after the first determination, of a ranked order of a plurality of product attributes including the product attribute, a third determination, after the second determination, of a

30   relative importance of one or more of the plurality of product attributes, and a fourth determination of a part worth value associated with an attribute level of

one of the plurality of attributes based at least on a classification of the attribute level and on a determined relative importance of the associated product attribute.

With these and other advantages and features that will become hereafter apparent, a more complete understanding of the nature of the invention can be

5   obtained by referring to the following detailed description and to the drawings appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a topographic view of a network architecture according to some

10   embodiments of the present invention.

FIG. 2 is a block diagram of an internal architecture of a server according to some embodiments of the present invention.

FIG. 3 is a block diagram of an internal architecture of a client system according to some embodiments of the present invention.

15   FIG. 4 is a block diagram of an internal architecture of a respondent device according to some embodiments of the present invention.

FIG. 5 is a representative view of a tabular portion of a product database according to some embodiments of the present invention.

FIG. 6 is a representative view of a tabular portion of a preference

20   information database according to some embodiments of the present invention.

FIGS. 7a and 7b comprise a flow diagram of process steps according to some embodiments of the present invention.

FIG. 8 is a view of an interface used to elicit information from a respondent according to some embodiments of the present invention.

25   FIG. 9 is a view of an interface used to elicit information from a respondent according to some embodiments of the present invention.

FIG. 10 is a view of an interface used to elicit information from a respondent according to some embodiments of the present invention.

FIG. 11 is a view of an interface used to elicit information from a

30   respondent according to some embodiments of the present invention.

FIG. 12 is a view of preference information as presented to a client according to some embodiments of the present invention.

DETAILED DESCRIPTION

Network Architecture

FIG. 1 is a topographic view of network architecture 100 according to
5   some embodiments of the present invention. Of course, many other
architectures may be used to implement embodiments of the invention. Shown
in FIG. 1 is server 200, depicted as a mainframe computer. Server 200 may be
used to perform process steps 700 of FIGS. 7a and 7b in order to determine
preference information of part worth values associated with a respondent and a
10   product. Server 200 may be operated by a company, such as assignee Blue
Flame Data, Inc., providing trade-off analysis services to manufacturers or other
clients desiring to obtain consumer preference information.

In operation, server 200 may use data input by respondents and/or clients,
as well as legacy data, third party data and/or observed behavior data to produce
15   such preference information. It should be noted that many other types of
computing hardware may be used to perform the functions of server 200,
including, but not limited to, a server, a workstation, a network, or any
combination of one or more of the foregoing. Further details of server 200 are
set forth below with respect to FIG. 2.

20   In communication with server 200 are client systems 300 and 301. Client
systems 300 and 301 may be used according to some embodiments of the
present invention to perform any functions required by a client, including
scheduling, inventory tracking, billing, accounting, etc. Client systems 300 and
301 may also be used by a product manufacturer to transmit attributes and
25   attribute levels for a given product to server 200 in order to have server 200
determine part worth values associated with each acceptable attribute and
attribute level. Other information that may be transmitted from client system 300
and 301 to server 200 includes information for modifying thresholds or other
parameters used by the server 200 to determine preference information
30   according to some embodiments of the present invention.

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Client systems 300 and 301 may also receive information from server 200 intended for display to a manufacturer or another client. Such information may include real-time monitoring of consumer responses, scenario simulations, or an interface allowing the operator to tweak existing thresholds or parameters while

5 information is being gathered from consumers. Of course, the manufacturer may also use client systems 300 and 301 to view preference information received thereby from server 200.

As shown in FIG. 1, client systems 300 and 301 comprise desktop computer systems. Any other suitable devices may be used as client systems

10 300 and/or 301 according to some embodiments of the invention, including but not limited to a workstation, a mainframe computer, a kiosk, a personal digital assistant and a computer terminal. In the case that one of client systems 300 and 301 comprises a system having its own input and/or output devices, such as a kiosk, a respondent may also use the system to input answers to inquiries

15 posed according to some embodiments of the invention and to input other indications to server 200. The system may also be used in such a case to present interfaces to the respondent that allow the respondent to input such information.

Server 200 may determine product attributes and attribute levels using

20 data from other sources such as data repository 400. Data repository 400 stores information usable by server 200 in accordance with the processes described herein. The information may include preference information, product information including product attributes and attribute levels, respondent demographic information, marginal costs of particular attribute levels, and process steps

25 executable to determine preference information. The information may be received by data repository 400 from other sources or may be generated, in whole or in part, by data repository 400.

Data used to determine preference information may be transmitted to and/or received from respondents through respondent devices 500 and 501. As

30 shown, such data may be transmitted to and received from a respondent device by a client system, such as client system 301. Respondent devices 500 and 501

11

respectively comprise a personal digital assistant and a workstation. However, respondent devices 500 and 501 may include any device or combination of devices capable of presenting information, visually and/or aurally, and of transmitting information to an external device. Of course, respondent devices

5   500 and 501 should be able to communicate with the device or devices with which they are in communication over whatever types of network media exist between the devices.

        Although the connections illustrated between the components of FIG. 1 appear dedicated, it should be noted that each of the connections may be shared

10   by other components. Moreover, the connections may comprise one or more of a local area network, a wide area network, a telephone network, a cellular network, a fiber-optic network, a satellite network, an infra-red network, a radio frequency network, or any other type of network which may be used to transmit information among two or more of the devices. Additionally, the devices shown

15   in communication with other devices need not be constantly exchanging data, rather, the communication may be established when necessary and severed at other times or always available but rarely used to transmit data.

        In one specific example of operation according to some embodiments of the invention, an operator of client system 300 executes a client application

20   which presents a dashboard interface to the operator. The client application may simply consist of a Web browser which requests a Web page including the dashboard interface from server 200 and displays the Web page to the operator. The operator manipulates the dashboard interface to specify a product for which preference information is desired and respondents to whom the preference

25   information should be associated. The respondents may be specifically identified and/or generally specified according to any type of characteristic. The operator may also specify attributes and attribute levels associated with the product, as well as parameters based on which the preference information should be determined. For example, the operator may use the dashboard interface to

30   indicate that a respondent may not specify any unacceptable attribute levels for

one or more attributes. As shown in FIG. 1, the attributes and/or attribute levels may be received from data repository 400.

The product, attributes, attribute levels, and/or parameters are transmitted to server 200 over a direct link or over a network, such as the World Wide Web.

5   Server 200 uses the transmitted information and/or information from outside sources such as data repository 400 to elicit responses from a respondent operating respondent device 500. The responses are then used to create accurate and useful preference information.

As will be described in detail with respect to FIGS. 7a and 7b, server 200

10   elicits the responses by first selecting a product attribute of the subject product. Next, an interface is presented to the respondent. The interface presents attribute levels associated with the selected attribute, and allows the respondent to designate a classification for each attribute level. Possible classifications include most-preferred, least-preferred, intermediately-preferred, unacceptable,

15   and required. One example of such an interface is described below with respect to FIG. 8.

Server 200 determines a classification of each attribute level of the selected product attribute based on the designations of the respondent. Classification of attribute levels continues for each attribute of interest. After

20   each attribute level has been classified, each attribute is assigned to one of one or more piles. In order to determine which attributes are assigned to which piles, the respondent is asked to group the attributes according to their importance. For example, the attributes may be grouped into three piles representing least-important attributes, most-important attributes, and other attributes. A pile is then

25   selected, and an interface is presented to the respondent asking the respondent to rank each attribute of the selected pile in order of importance. Server 200 determines a ranked order of the attributes of the pile based on the respondent's ranking.

Server 200 then determines a relative importance of one or more of the

30   attributes of the pile to another attribute of the pile based on a response received from the respondent. The response is an answer to a question such as "How

important is the difference between (attribute level X) and (attribute level Y) of (attribute 1) relative to the difference between (attribute level A) and (attribute level B) of (attribute 2)?" Determination of the ranked order and the relative importance is performed for each other pile of attributes.

5   Finally, server 200 determines preference information comprising part worth values associated with several of the attribute levels. By virtue of features of some embodiments of the invention, the preference information is more accurate and useful than previously available preference information because the respondent is presented with queries that are easier to comprehend and easier

10   to accurately answer.

Server

FIG. 2 is a block diagram of the internal architecture of server 200 according to some embodiments of the invention. As illustrated, server 200

15   includes microprocessor 210 in communication with communication bus 220. Microprocessor 210 may be a Pentium, RISC-based, or other type of processor and is used to execute processor-executable process steps so as to control the components of server 200 to provide desired functionality.

Also in communication with communication bus 220 is communication port

20   230. Communication port 230 is used to transmit data to and to receive data from external devices. Communication port 230 is therefore preferably configured with hardware suitable to physically interface with desired external devices and/or network connections. In one embodiment, interfaces are transmitted to and designations are received from respondent device 500 over

25   communication port 230.

Input device 240, display 250 and printer 260 are also in communication with communication bus 220. Any known input device may be used as input device 240, including a keyboard, mouse, touch pad, voice-recognition system, or any combination of these devices. Input device 240 may be used by an

30   operator to input product-related information such as attributes and attribute levels, respondent-related information such as contact and identification

information, client-related information such as billing and transaction information, and commands to server 200. In this regard, input device may be used to input a command to server 200 for outputting a report detailing a particular client's account or a particular respondent's or group of respondent's preference

5   information.

Such a report may be output to display 250, which may be an integral or separate CRT display, flat-panel display or the like. Display 250 is used to output graphics and text to an operator in response to commands issued by microprocessor 210. Printer 260 is also an output device, but produces a

10   hardcopy of data using ink-jet, thermal, dot-matrix, laser, or other printing technologies.

RAM 270 is connected to communication bus 220 to provide microprocessor 210 with fast data storage and retrieval. In this regard, processor-executable process steps being executed by microprocessor 210 are

15   typically stored temporarily in RAM 270 and executed therefrom by microprocessor 210. ROM 280, in contrast, provides storage from which data can be retrieved but to which data cannot be stored. Accordingly, ROM 280 is used to store invariant process steps and other data, such as basic input/output instructions and data used during system boot-up or to control communication

20   port 230.

Data storage device 290 stores, among other data, processor-executable process steps of server application 292. According to some embodiments of the present invention, the process steps of server application 292 may be read from a computer-readable medium, such as a floppy disk, a CD-ROM, a DVD-ROM, a

25   Zip disk, a magnetic tape, or a signal encoding the process steps, and then stored in data storage device 290. Server application 292 may be stored in data storage device 290 in a compressed, uncompiled and/or encrypted format. Microprocessor 210 executes instructions of application 292, and thereby operates in accordance with the present invention, and particularly in accordance

30   with the process steps described in detail herein.

Specifically, according to some embodiments of the invention, microprocessor 210 executes processor-executable process steps of server application 292 to provide for a first determination, for each of a plurality of attribute levels associated with a product attribute, of a classification of the

5 attribute level as one of unacceptable, most-preferred, least-preferred, or intermediately-preferred, a second determination, after the first determination, of a ranked order of a plurality of product attributes including the product attribute, a third determination, after the second step, of a relative importance of one or more of the plurality of product attributes, and a fourth determination of a part worth

10 value associated with an attribute level of one of the plurality of attributes based at least on a classification of the attribute level and on a determined relative importance of the associated product attribute.

Also according to some embodiments of the invention, the process steps provide a user interface including a plurality of selectable graphical elements

15 each representing a respective attribute level of a product attribute, a first area for presenting at least one of the plurality of selectable graphical elements that has been designated by a respondent as representing an unacceptable attribute level, a second area for presenting one of the plurality of selectable graphical elements that has been designated by the respondent as representing a least-

20 preferred attribute level, and a third area for presenting one of the plurality of selectable graphical elements that has been designated by the respondent as representing a most-preferred attribute level.

In alternative embodiments, hard-wired circuitry may be used in place of, or in combination with, processor-executable process steps for implementation of

25 the processes of some embodiments of the present invention. Thus, embodiments of the present invention are not limited to any specific combination of hardware and software.

Also included in server application 292 may be processor-executable process steps to provide a Web server. Such a Web server would allow server

30 200 to communicate with client systems 300 and 301 as well as respondent devices 500 and 501 through the World Wide Web.

Also stored in data storage device 290 is product database 294 and preference information database 296. Product database 294 includes information used to determine preference information associated with particular products and preference information database 296 includes preference

5   information determined according to some embodiments of the present invention. These databases will be discussed in detail with reference to FIGS. 5 and 6, respectively.

Data storage device 290 furthermore includes program elements that may be necessary for operation of server 200, such as an operating system, a

10   database management system and device drivers for allowing microprocessor 210 to interface with devices in communication with communication port 230. These program elements are known to those skilled in the art, and need not be described in detail herein. Of course, data storage device 290 may also include applications and data for providing functionality unrelated to the present

15   invention.

Client System

FIG. 3 illustrates an internal architecture of client system 300. As shown, client system 300 according to the depicted embodiment includes

20   microprocessor 310, communication port 330, input device 340, display 350, printer 360, RAM 370 and ROM 380, each of which is in communication with communication bus 320. Possible embodiments for each of these components are similar to those described with respect to identically-named components of FIG. 2, although functions performed by the components of FIG. 3 according to

25   some embodiments of the invention may differ from those performed by the components of FIG. 2.

Specifically, input device 340 may be used by a manufacturer operating client system 300 to input product attributes and attribute levels for which preference information is sought, and also to input demographic information of a

30   typical respondent from whom preference information is desired. Display 350 and printer 360 may be used to output information received from server 200,

such as preference information. Of course, this information may be determined by client system 300 instead of being received from server 200. In a case that client system 300 is a kiosk or other device usable by both a respondent and a client manufacturer, input device 340, display 350 and printer 360 may also be

5   used by a respondent to receive inquiries from and to input responses to inquiries and other indications to server 200.

Data storage device 390 stores client application 392, product database 394 and preference information database 396. Client application 392 includes processor-executable process steps which may be executed by microprocessor

10   310 to perform the process steps described herein. According to some embodiments of the invention, client application 392 includes process steps to provide the functions attributed herein to server 200.

Client application 392 may also include processor-executable process steps to provide a Web browser. As described with respect to server 200, a Web

15   browser would allow client system 300 to communicate with a Web server executed by server 200.

Product database 394 includes information similar to that included in product database 294. The information included in product database 394, however, is input in some embodiments by a manufacturer operating client

20   system 300. Preference information database 396 includes preference information that may be transmitted by server 200 to client system 300 or may be generated by client system 300 according to some embodiments of the invention.

As mentioned with respect to server 200, data storage device 390 may also store applications, data, operating system and device driver files used to

25   provide functionality that is related and/or unrelated to the present invention.

Respondent Device

FIG. 4 illustrates several components of respondent device 500 according to some embodiments of the invention. As briefly described above,

30   communication port 530 may be used to receive interfaces and/or queries from server 200 and to transmit responses and/or designations in response thereto.

18

In this regard, input device 540 may be used by a respondent to manipulate an interface presented on display 550 so as to designate an attribute level as unacceptable, required, most-preferred, least-preferred, or intermediately-preferred. Input device 540, display 550 and printer 560 may also be used in

5   conjunction with other applications provided by respondent device 500 which are unrelated to the present invention.

Storage device 590 of respondent device 500 stores processor-executable process steps of Web browser 592. The process steps may be executed by microprocessor 510 to allow communication with Web servers such as the Web

10   server provided by server application 292 of server 200. Authorization information 594 includes information used to determine whether a user of respondent device 500 is authorized to receive interfaces and/or queries from server 200. For example, authorization information 594 may include usernames and passwords of users who might operate respondent device 500. The

15   information may also be transmitted to server 200 to ensure that a user of respondent device 500 is a respondent of whom preference information is desired. Information may be stored in authorization information 594 in the form of Web cookies.

Storage device 590 may store one or more of other applications, data

20   files, device drivers and operating system files needed to provide functions other than those directly related to the present invention. Such functions may include calendaring, e-mail access, word processing, accounting, presentation development and the like.

25   <u>Product Database</u>

A tabular representation of a portion of product database 294 is shown in FIG. 5. Product database 294 stores data specifying attributes and associated attribute levels for particular products and particular clients. Specifically, client:product field 502 indicates a client and a product, while attribute field 504

30   and attribute levels field 506 respectively specify attributes and attribute levels that are to be evaluated for the client with respect to the product. Accordingly,

the FIG. 5 representation provides client-specific attributes and attribute levels for a particular product. Of course, product database 294 may specify attributes and attribute levels for a particular product that are not associated with any one particular client.

5   Also associated with attribute field 504 and attribute levels field 506 in a single record are implicit order flag field 508 and unacceptable levels allowed? field 510. Implicit order flag field 508 indicates whether or not associated attribute levels are listed in order of consumer preference. Usage of implicit order flag field 508 will be described below. Unacceptable levels allowed? field

10   510 specifies whether or not a respondent will be allowed to classify any of the associated attribute levels as unacceptable. It should be noted that data of attribute field 504, attribute levels field 506, implicit order flag field 508 and unacceptable levels allowed? field 510 may be specified by a respondent or by a client and received by server 200 from client system 300, respondent device 500,

15   and or from one or more other sources. Of course, server 200 may also determine the data independently.

Although shown in FIG. 5 are data specifying particular attributes and attribute levels, some embodiments of the invention contemplate evaluating fewer or more attributes and/or attribute levels for any particular product.

20   Additionally, it is contemplated that product database 294 may store data for multiple products and/or multiple clients. In contrast, it is contemplated that, in some embodiments, product database 394 of in client system 300 might store only data associated with the particular client operating client system 300.

The data stored in product database 294 may be used in accordance with

25   some embodiments of the present invention to determine preference information relating to the attributes and attribute levels of fields 504 and 506. One such embodiment was described above with respect to FIG. 1. After this determination, the preference information may be stored in preference information database 296, and/or transmitted to client system 300 for storage in

30   preference information database 396.

Preference Information Database

FIG. 6 shows a tabular representation of a portion of preference information database 296 according to some embodiments of the invention. The data stored in preference information database 296 reflects preference

5   information associated with a respondent and/or with a group of respondents. As shown by respondent:product field 602, the portion reflects preference information of a single respondent with respect to a single product. Each record in the tabular portion includes attribute field 604 and attribute level/associated part worth value field 606. A part worth value associated with an attribute level

10   represents a respondent's preference for the attribute level as determined according to some embodiments of the present invention. This determination will be described in detail below with respect to FIGS. 7a and 7b.

As mentioned with respect to product database 294, the data stored in preference information database 296 for a particular product may reflect fewer or

15   more attributes and/or attribute levels than shown in FIG. 6. Furthermore, it is contemplated that preference information database 296 will store data corresponding to multiple respondents and to multiple products for some of the respondents. On the other hand, it is contemplated that preference information database 396 of client system 300 might store preference information of multiple

20   respondents but corresponding only to those products to be sold by the particular client operating client system 300.

As will be understood by those skilled in the art, the tabular illustrations and accompanying descriptions of product database 294 and preference information database 296 merely represent relationships between stored

25   information. A number of other arrangements may be employed besides those suggested by the illustrations. Similarly, the illustrated entries of the databases represent sample information only; the reader will understand that the number and content of the entries can be different from those illustrated.

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Specific Example

FIGS. 7a and 7b comprise a flow diagram of process steps 700 to
determine preference information according to some embodiments of the present
invention. Process steps 700 are described herein as being performed by server

5   200 through execution of processor-executable process steps of server
application 292 by microprocessor 210. However, the process steps may also be
performed, in whole or in part, by one or more of server 200, client systems 300
and 301, respondent devices 500 and 501, another device, and manual means.

A plurality of product attributes and associated attribute levels for a subject

10   product is initially determined in step S701. In the example set forth below, the
subject product is a pair of downhill skis, and the attributes are "Brand", "Price",
"Length", "Type" and "Warranty". Each determined attribute is associated with
one or more attribute levels, which are shown in association with the attributes in
product database 294 of FIG. 5. Accordingly, the attributes may be determined

15   by server 200 in step S701 by referring to attributes associated with the subject
product in product database 294. Server 200 may also determine the attributes
by receiving data representing the attributes from an operator via input device
240 or by receiving data representing the attributes from client system 300. In
the latter case, client system 300 may retrieve the attributes from product

20   database 394 or from an operator operating input device 340. Moreover, the
attributes may be determined in step S701 by receiving the attributes from a
respondent after identifying the product to the respondent. In this regard, the
respondent may be asked to select or specify the attributes and/or attribute levels
which are of concern when deciding whether to purchase the product.

25   One of the determined attributes is selected in step S702. Next, in step
S703, a classification is determined for each of a plurality of attribute levels
associated with the selected attribute. In some embodiments, the classification is
determined based on designations received from a respondent. FIG. 8 illustrates
a user interface usable to receive designations from a respondent. User

30   interface 800 may be included within a Web page generated by a Web server
executing within server 200 and transmitted to respondent device 500, which in

22

turn presents interface 800 using display 550. User interface 800, as well as the other user interfaces described below, may originate at server 200 and be transmitted to respondent device 500 directly from server 200 or from server 200 through an intermediate device such as client system 300. Similarly, the user

5   interfaces described herein may originate at client system 300 and be transmitted to respondent device 500 directly or through an intermediate device.

Generally, user interface 800 includes interface elements manipulable by a respondent to designate one or more product attribute levels as unacceptable, to designate a first attribute level as a least-preferred attribute level, and to

10   designate a second attribute level as a most-preferred attribute level. More specifically, the FIG. 8 interface includes a plurality of selectable graphical elements 810, with each of graphical elements 810 representing a respective attribute level of the attribute selected in step S702. Interface 800 also includes area 820 for presenting at least one of the plurality of selectable graphical

15   elements 810 that has been designated by the respondent as representing an unacceptable attribute level, area 830 for presenting one of the plurality of selectable graphical elements 810 that has been designated by the respondent as representing a least-preferred attribute level, and area 840 for presenting one of the plurality of selectable graphical elements 810 that has been designated by

20   the respondent as representing a most-preferred attribute level.

Interface 800 also includes area 850 for presenting one or more of the plurality of selectable graphical elements 810 that has been designated by the respondent as representing an intermediately-preferred attribute level. As shown, area 850 includes a scale that associates a position of a graphical

25   element within area 850 with a quantitative scale value between 0 and 10 that represents the respondent's preference for the attribute level represented by the graphical element with respect to the most- and least-preferred attribute levels. Of course, other scale ranges may be used in conjunction with some embodiments of the invention.

30   Moreover, interface 800 includes area 860 for presenting one or more of the plurality of selectable graphical elements 810 that has been designated by

23

the respondent as representing a required attribute level. An attribute level designated as required overrules all other level designations. Accordingly, an attribute level A that was previously designated "most-preferred" will be overruled if attribute level B is designated as required. For attribute levels that are

5   associated with a particular attribute and are mutually-exclusive, area 860 may be limited to presenting one attribute level.

In some embodiments, all selectable graphical elements 810 are located in area 870 when interface 800 is initially presented to a respondent. In one specific example, the respondent operates input device 540 to select and drag

10   one or more of elements 810 from area 870 to an area of interface 800 in order to designate that the attribute levels represented by the dragged elements are unacceptable, most-preferred, least-preferred, intermediately-preferred, or required. In some embodiments, interface 800 may present a message to the respondent in response to an element being dragged to area 820. One example

15   of such a message is: "You have rated attribute level X as unacceptable. You will never be offered a product that includes this attribute level, thereby limiting the products that are offered to you. Are you sure that you want to rate this attribute level as unacceptable?"

The respondent selects one of Continue icons 880 after designating

20   classifications of zero, one, several or all of elements 810. In some embodiments, icon 880 is selectable only if each attribute level represented in interface 800 has been designated as unacceptable, most-preferred, least-preferred, intermediately preferred, or required. Some embodiments may require that at least two attribute levels are not designated as unacceptable. Selection of

25   one of icons 880 causes the designations to be transmitted to server 200. Accordingly, classifications are determined based on the received designations.

User interface 800 also includes Skip Attribute icon 890. Selection of icon 890 allows a respondent to stop designating attribute levels of the displayed attribute and, in some embodiments, to begin designating attribute levels of

30   another attribute. In some embodiments, any undesignated attribute levels are inferred. As a result, if the respondent selects a "most-preferred" attribute level,

and then selects icon 890, remaining undesignated attribute levels are ignored in further processing. Even those designations made prior to selection of icon 890 are ignored in some embodiments.

It should be noted that interfaces different from interface 800 may be used
5   to receive attribute level designations from a respondent. In some embodiments, a client for whom preference information is being determined may instruct server 200, using client application 392, that a respondent may not designate attribute levels of a particular one or more attributes as unacceptable. Accordingly, area 820 of interface 800 associated with the particular attributes may be removed,
10   "grayed-out", or otherwise disabled. In a case that one of the particular attributes is also implicit, user interface 800 corresponding to that attribute may pre-populate areas 830 and 840 with graphical elements representing a least-preferred and a most-preferred attribute level.

Other features may be based on whether an attribute is implicit. For
15   example, some embodiments of interface 800 may prevent a respondent from designating an attribute level of an implicit attribute as unacceptable unless every less-preferable attribute level has been designated as unacceptable. In some embodiments, all the less-preferable attribute levels are automatically designated as unacceptable in response to a designation of an attribute level of an implicit
20   attribute as unacceptable. In other examples, an attribute level of an implicit attribute is designated as most-preferred and all attributes having a higher implicit desirability are automatically designated as unacceptable. In some embodiments, attribute levels must be designated consistently with their implicit ordering.

25   According to some embodiments, removing an attribute level from area 820 results in removing the designation of the attribute level as unacceptable and also causes all previously-designated attribute levels to lose their designations. For example, each attribute level may be moved back to area 860.

Flow proceeds from step S703 to step S704 to determine if all the
30   attributes determined in step S701 have been selected. If not, a next attribute is selected and flow returns to step S703 to determine a classification for each of a

plurality of attribute levels associated with the newly-selected attribute. Flow therefore cycles between steps S703 through S705 until classifications have been determined for all attribute levels of each attribute determined in step S701.

In some embodiments of the invention, an interface showing attribute
5   levels of an attribute is not presented in step S703 if the attribute is implicit and consists of two attribute levels, such as the Warranty attribute of the present example. According to these embodiments, the less-desirable implicit attribute level is determined in step S703 to be a least-preferred attribute level and the most-desirable implicit attribute level is determined to be a most-preferred
10 attribute level without receiving a designation from the respondent.

Next, in step S706, one or more piles of attributes are determined. The piles may be determined by presenting interface 900 of FIG. 9 to a respondent. Interface 900 asks the respondent to manipulate the interface so as to designate each attribute as either "unimportant", "less important" or "important". In terms of
15 the present disclosure, the "unimportant", "less important" and "important" designations refer to separate attribute piles. It should be noted that three or more piles may be determined in accordance with the present invention. In other embodiments, user interface 900 is presented to a respondent only if the number of attributes is greater than a threshold number, such as nine. The threshold
20 number may depend on an amount of time in which process steps 700 must be completed or on a maximum number of questions to be asked to the respondent, and may be set by server 200, client system 300 or respondent device 500.

Server 200 then selects one of the piles in step S707 and determines a ranked order of attributes in the selected pile in step S708. Such a ranked order
25 may be determined by forwarding user interface 1000 of FIG. 10 to respondent device 500 and receiving input thereto. Although user interface 1000 specifies a ranked order according to numbers assigned to each attribute, a ranked order may also be determined by asking the respondent to specify a difference in desirability of the most-desirable and the least-desirable attribute level of each
30 attribute. The attributes are then ranked according to the differences, with the

attribute having the greatest difference being the highest-ranked attribute. Such ranking may be performed for one, some, or all piles.

User interface 1100 of FIG. 11 is then used in step S709 to determine a relative importance of the attributes of the selected pile with respect to the

5   highest-ranked attribute of the pile. In the embodiment of FIG. 11, the importance is determined by asking the respondent to rate, for each attribute other than the highest-ranked attribute, the importance of the most-preferred attribute level versus the least-preferred attribute level as compared to the importance of the most-important attribute's most-preferred attribute level versus

10   its least-preferred level.

In some embodiments, the above question is asked with respect to each attribute according to ranked order. That is, a relative importance of a second-ranked attribute is determined before the relative importance of a third-ranked attribute. According to some embodiments, the respondent is asked to rate the

15   importance of fewer than all of the remaining attributes of the selected pile. For example, a respondent may be asked to rank the importance of the top 20 attributes or the top 20% of attributes in the selected pile, based on the determined ranked order. The amount of attributes rated may be selected by the client, selected by the respondent, or assumed by server 200 based on any

20   factor, including a time allotted to receive information from the respondent. The unrated attributes according to these embodiments may be assigned importances based on their relative ranks. In this regard, in a case that a sixth-lowest ranked attribute is assigned a relative importance of 12%, the attributes having the five lowest ranks may be automatically assigned relative importances

25   of 10%, 8%, 6%, 4%, and 2%, respectively.

The relative importances of all attributes may also be determined by designating the most-important attribute in the selected pile as having a relative importance of 100% and asking the respondent to specify percentage values for each other attribute in the pile. Moreover, the relative importance of an attribute

30   may be determined by evaluating a rating of the respondent of the importance of the difference between the most-preferred and least-preferred attribute levels of

the attribute relative to the difference between the most-preferred and least-preferred attribute levels of the highest-ranked attribute.

Additionally, the relative importance may be determined in step S709 through a respondent rating of the importance of the difference between the

5   most-preferred and least-preferred attribute levels of the attribute relative to the difference between the most-preferred and least-preferred attribute levels of the lowest-ranked attribute. The relative importances may also be based on the attribute ranking received through user interface 900, wherein, for example, the highest-ranked attribute is assigned a 100% relative importance, the lowest-

10 ranked attribute is assigned a 1% importance and the remaining attributes are spaced evenly within the intervening range.

Next, in step S710, it is determined whether any of the piles determined in step S706 have not been selected. If so, flow continues to step S711, wherein a next pile is selected and flow returns to step S708. If not, flow proceeds to step

15 S712. In some embodiments, flow proceeds to step S712 from step S710 even if one or more of the determined piles has not been selected. According to these embodiments, all piles are not subjected to steps S708 and S709 because of time constraints, instructions from client system 300, or other factors.

In step S712, a part worth value of each attribute level may be determined

20 based on its associated scale value and the relative importance of its associated attributes. In the present example, attribute level "Atomic" was determined to have a scale value of "7" based on input to user interface 800. Additionally, "Brand" was determined to be the most-important attribute based on input to user interface 1000, and therefore was assigned a relative importance of 100% in step

25 S709. Accordingly, the part worth value associated with "Atomic" is (100% x 7) = 7. Similarly, the part worth values corresponding to "Rossignol" and "Solomon" are (100% x 10) = 10 and (100% x 0) = 0, respectively. The attribute level "Volkl" is not associated with a part worth value because the attribute level was designated as unacceptable.

30 Preference information database 296 of FIG. 6 is populated with preference information determined according to the present example of some

embodiments of the invention. As shown, an unacceptable attribute level has no part worth value and the associated value is therefore represented by "X".

FIG. 12 is a view of preference information 1200 as presented to a client according to some embodiments of the present invention. Preference

5   information 1200 is intended to provide a client with a comprehensible breakdown of preference information determined according to some embodiments of the present invention. Preference information 1200 may be presented to the client in many ways, including by transmitting data representing preference information 1200 to client system 300, by transmitting a Web page

10   including preference information 1200 to client system 300, by displaying preference information 1200 to the client using display 250 or display 350, and by providing to the client a hardcopy of preference information 1200 produced using printer 260 or printer 360. As shown, preference information 1200 reflects the data stored in preference information database 296 of FIG. 6.

15   Although the present invention has been described with respect to particular embodiments thereof, those skilled in the art will note that various substitutions may be made to those embodiments described herein without departing from the spirit and scope of the present invention.